Exhibit D

EXPERT REPORT OF ODED GOTTESMAN, Ph.D.

My name is Oded Gottesman, and I was asked to write this report by TruePosition, Inc. ("TruePosition"). I was specifically asked to consider whether Andrew Corporation ("Andrew") has infringed U.S. Patent 5,327,144 (the '144 Patent). I understand that TruePosition has sued Andrew for infringement of U.S. Patent 5,327,144 (the '144 Patent). I have been retained by TruePosition because of my expertise in the areas of telecommunications, computer programming, signal processing, speech coding, and transmission over networks, including radio communications in cellular networks.

This report considers the '144 Patent, and my opinion that Andrew infringes the 144 Patent because the 144 Patent claims encompass configurations of Andrew's Mobile Location System product known as the "Geometrix® Wireless Location System."

I. Summary of My Opinions

Based upon my 19 years of experience in the signal processing and telecommunications industry, I believe that Andrew has infringed Claims 1, 2, 22 , 31, and 32 (the "Asserted Claims") of the '144 Patent by using and offering to sell certain configurations of its Geometrix® Wireless Location System, and by supplying from the United States the components of the Geometrix® Wireless Location System.

More specifically, in December 2004, Andrew infringed Claims 1 and 2 of the 144 Patent by offering for sale within the United States a configuration of the Geometrix® Wireless Location System to Saudi Telecom Company ("STC"), a cellular telephone network operator in Saudi Arabia.

In about August/September 2005, Andrew also infringed Claim 31 of the 144 Patent by using within the United States a configuration of the Geometrix® Wireless Location System at a demonstration at its Ashburn, Virginia, facility.

Between October, 2005 and February, 2006, Andrew again infringed Claims 1 and 2 of the 144 Patent by offering for sale configurations of the Geometrix® Wireless Location System to STC.

After October, 2005, Andrew also repeatedly infringed Claims 1, 2, 22, 31 and 32 of the 144 Patent by supplying from the United States to Saudi Arabia components of a system comprising a combination of Andrew's Geometrix® Wireless Location System and STC's cellular telephone system, and by supplying components of a method performed during the operation of that combination system.

After October, 2005, Andrew also repeatedly infringed Claims 1, 2, 22, 31 and 32 of the 144 Patent by supplying from the United States to Saudi Arabia components of a system comprising a combination of Andrew's Geometrix® Wireless Location System, STC's cellular telephone system and a Location Based Services database owned or operated by STC, and by supplying components of a method performed during operation of that combination system.

[31] *See* 10/02/06 Deposition Transcript of John Carlson, p. 72, ll. 11-25.

[32] *See* PX-116 at 9.

[33] *See* 10/02/06 Deposition Transcript of John Carlson, p. 67, l. 20 – p. 82, l. 17; p. 120, l. 10 – p. 123, l. 13.

Oded Gottesman Report:

[34] *See* 10/02/06 Deposition Transcript of John Carlson, p. 74, ll. 17-23.

[35] *See* PX-63 at 13.

[36] *Id.*

[38] *See* 10/02/06 Deposition Transcript of John Carlson, p. 98, l. 1 – p. 102, l. 6.

[39] *See* AND0023010-AND0023088, file *send.c.*

[40] *See* AND0042137, file *geo_defs.h.*

[41] *See* AND0023048- AND0023049.

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Oded Gottesman Report:

Oded Gottesman Report:

[52] *See* also 10/02/06 Deposition of John Carlson at p. 90, ll. 2-23.

[53] *See* AND0007312; AND0006681 – AND0006685.

[54] *See* (AND006687 – AND006693.

[55] *See* Seymour Stein, "Algorithms for Ambiguity function processing," IEEE Trans. ASSP, Vol. ASSP-28, No. 3, pp.588 - 599 June 1981; 10/02/06 Deposition Transcript of John Carlson at p.106, l. 6 – p. 113, l. 24.

[56] *See* Charles H. Knapp and G. Clifford Carter, "The generalized correlation method for estimation of time delay," IEEE Trans. ASSP, Vol. ASSP-24 No.4 , pp. 320 – 327, August 1976.

(b) the structure of the element in the accused product has to be either the same or equivalent.

E.1 Analysis of Geometrix® Wireless Location System and the '144 Patent

The following sections explain why I believe Andrew infringes the 144 Patent.

E.2 Andrew's December 2004 Offer for Sale to STC – Claims 1 and 2

E.2.1 CLAIM 1 OF THE '144 PATENT

E.2.1.1 Claim 1 Recitation

A cellular telephone location system for determining the locations of multiple mobile cellular telephones each initiating periodic signal transmission over one of a prescribed set of reverse control channels, comprising:

(a) at least three cell site systems, each cell site system comprising: an elevated ground-based antenna; a baseband convertor operatively coupled to said antenna for receiving cellular telephone signals transmitted over a reverse control channel by said cellular telephones and providing baseband signals derived from the cellular telephone signals; a timing signal receiver for receiving a timing signal common to all cell sites; and a sampling subsystem operatively coupled to said timing signal receiver and said baseband convertor for sampling said baseband signal at a prescribed sampling frequency and formatting the sample signal into frames of digital data, each frame comprising a prescribed number of data bits and time stamp bits, said time stamp bits representing the time at which said cellular telephone signals were received; and

(b) a central site system operatively coupled to said cell site systems, comprising: means for processing said frames of data from said cell site systems to generate a table identifying individual cellular telephone signals and the differences in times of arrival of said cellular telephone signals among said cell site systems; and means for determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals.

E.2.1.2 GEOMETRIX system does perform all elements of method Claim 1

The following section describes how the "Geometrix® Wireless Location System" offered to STC operates and how it includes all the elements of system Claim 1 of the '144 Patent.

E.2.1.3 First Clause of Claim 1: "A cellular telephone location system for determining the locations of multiple mobile cellular telephones each initiating periodic signal transmission over one of a prescribed set of reverse control channels, comprising:"

The first clause of Claim 1 is **"A cellular telephone location system for determining the locations of multiple mobile cellular telephones each initiating**

periodic signal transmission over one of a prescribed set of reverse control channels, comprising:"

In my opinion, the "Geometrix® Wireless Location System" offered to STC, is literally a system for determining the locations of multiple mobile cellular telephones each initiating periodic signal transmissions over one of a prescribed set of reverse control channels.[70] The system offered was for determining the locations of multiple mobile cellular telephones because that is the purpose of Andrew's product.[71] The multiple cellular telephones each initiate periodic signal transmissions over a standalone dedicated control channel because STC's network is a GSM network as mentioned earlier in this report.[72] Phones in GSM cellular networks normally transmit on the SDCCH for call set up, location updates, registration and in other circumstances as well.

I understand that Andrew my claim that this element is not satisfied because SDCCH transmissions are not "periodic" within the meaning of the 144 Patent. In fact, SDCCH transmissions are transmitted at regular intervals, as exemplified by the recurring 51 frame SDCCH structure illustrated earlier in my report. In any event, the 144 Patent defines "periodic" as "discontinuous," meaning occurring from time to time, which SDCCH transmissions certainly do. Col. 2, ll. 19-22.

I also understand that Andrew may claim that this claim element is not satisfied because the 144 patent is limited to "AMPS" control channels, "analog" control channels, or control channels within a particular band. As fully described earlier, the control channels in an AMPS system are digital, not analog, and the preferred embodiment in Stilp also described digital control channels. The patent cannot be limited to analog control channels.

The patent also specifically states that it is applicable to digital systems that were known at the time (Col. 1, ll. 5-10; Col. 1, ll. 27-30) and since GSM, TDMA and CDMA were known , the patent cannot be limited to control channels that exclude these digital protocols, nor can it be limited to the frequency bands in an AMPS cell phone network. One of ordinary skill would have expected the inventors to describe AMPS more extensively in the patent, or at least mention AMPS, had they intended the patent to be limited to AMPS. Significantly, based on my review of the deposition transcripts of John Webber and Curtis Knight, it appears that neither Mr. Knight nor Mr. Webber have any expertise in AMPS, which suggests that they did not invent an AMPS-specific invention. Their expertise instead appears to be in the area of radio communications.

If the Court should construe the claims in accordance with Andrew's proposed construction of "reverse control channel" and, further, the court should construe the

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[70] See, e.g., PX-218 at 2 of 55. "Our offer to STC is to satisfy the UTDOA requirements of the location based service (LBS) network components with our Geometrix® Wireless Location System."

[71] See, e.g., PX-218 at 32-33 of 55, Fig. 2.2.11.

[72] See, e.g., PX-218 at 33 of 55, noting that the offered system will locate the phones "where interaction occurs on the SDCCH [standalone dedicated control channel] (such as an SMS message or a registration)"; 10/16/06 Deposition Transcript of Andrew Corporation by Joe Kennedy [36], p. 39, ll. 18-25.

preamble of this claim as limiting, then I expect to testify that this claim element is met under the doctrine of equivalents. SDCCH transmissions perform substantially the same function as an AMPS control channel transmissions, in substantially the same way to obtain substantially the same result. The function of both the SDCCH and the AMPS control channel transmissions is to convey digital control information. As mentioned earlier in my report, both AMPS and GSM use digital control channels. Furthermore, both the AMPS control channel transmissions and SDCCH transmissions convey such digital information in substantially the same way--over frequency bands, the difference being that the SDCCH is also defined by time slot. Finally the result is also substantially the same. In the context of cellular network, the result is a call being set up or digital control information otherwise being put to use. In the context of a location system like that claimed in the patent (i.e., like Geometrix), the transmission facilitates cell phone location.

Furthermore, having reviewed the file story the inventors did not disclaim coverage of control channels outside of AMPS.

E.2.1.4 Second Clause of Claim 1: "(a) at least three cell site systems, each cell site system comprising: an elevated ground-based antenna; a baseband convertor operatively coupled to said antenna for receiving cellular telephone signals transmitted over a reverse control channel by said cellular telephones and providing baseband signals derived from the cellular telephone signals; a timing signal receiver for receiving a timing signal common to all cell sites; and a sampling subsystem operatively coupled to said timing signal receiver and said baseband convertor for sampling said baseband signal at a prescribed sampling frequency and formatting the sample signal into frames of digital data, each frame comprising a prescribed number of data bits and time stamp bits, said time stamp bits representing the time at which said cellular telephone signals were received; and"

The second clause of Claim 1 is: **"(a) at least three cell site systems, each cell site system comprising: an elevated ground-based antenna; a baseband convertor operatively coupled to said antenna for receiving cellular telephone signals transmitted over a reverse control channel by said cellular telephones and providing baseband signals derived from the cellular telephone signals; a timing signal receiver for receiving a timing signal common to all cell sites; and a sampling subsystem operatively coupled to said timing signal receiver and said baseband convertor for sampling said baseband signal at a prescribed sampling frequency and formatting the sample signal into frames of digital data, each frame comprising a prescribed number of data bits and time stamp bits, said time stamp bits representing the time at which said cellular telephone signals were received; and"**

In my opinion, the "Geometrix® Wireless Location System" offered to STC literally includes all of the elements of this clause. I will now explain element by element how the "Geometrix® Wireless Location System" offered to STC infringes includes all of those elements literally.

III. The Bases and Reasons for My Infringement Opinions

[73] See, e.g., PX-218 at 20 of 55, Table 2.1.1.

[74] See, e.g., PX-218 at 10 of 55, noting that the offered LMU's/WLS's are connected "to a combination GPS/downlink antenna."

[75] See, e.g., PX-115 Blocks "RFD" and "DDC"; AND0080260 – AND0080328.

[76] See, e.g., 10/14/06 Deposition Transcript of Alan Li at p. 149, ll.1-13.

[77] See, e.g., PX-115.

[78] See, e.g., PX-218 [6] at 33 of 55, noting that the offered system will locate the phones "where interaction occurs on the SDCCH [standalone dedicated control channel] (such as an SMS message or a registration)."

E.2.1.5 Third Clause of Claim 1: "(b) a central site system operatively coupled to said cell site systems, comprising: means for processing said frames of data from said cell site systems to generate a table identifying individual cellular telephone signals and the differences in times of arrival of said cellular telephone signals among said cell site systems; and means for determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals."

The third clause of Claim 1: **"(b) a central site system operatively coupled to said cell site systems, comprising: means for processing said frames of data from said cell site systems to generate a table identifying individual cellular telephone signals and the differences in times of arrival of said cellular telephone signals among said cell site systems; and means for determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals."**

In my opinion, the "Geometrix® Wireless Location System" offered to STC literally includes all of the elements of the third clause of claim 1. I will now explain element by element how the "Geometrix® Wireless Location System" offered to STC literally includes all of the elements of the third clause of Claim 1.

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[86] See, e.g., AND_EF0096141; AND_EF0095938; AND0018865.

[87] See, e.g., PX-218 at 24 of 55, noting that the "TDOA technique works by measuring the exact time of arrival of a radio signal at three or more separate cell sites"; AND_EF0096141; AND_EF0095938; AND0018865.

- **"(b) a central site system operatively coupled to said cell site systems, comprising:"**

- **"and means for determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals."**

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[88] See, e.g., PX-218 at 20 of 55, Fig. 2.1.1.

[89] See, e.g., PX-218at 13 of 55 noting that the GCS "calculates location estimates based on measurements made by LMU's."

[90] See AND0019024 – AND0019038, AND0020896 – AND0021415, AND0021427 – AND0021962, and AND0022177 – AND0023010; 09/22/06 Deposition Transcript of Andrew Beck at p. 62, l. 1 – p. 64, l. 7; p. 216, ll. 17- 24; AND_EF134186 noting that "by calculating the difference in arrival time at pairs of cell sites, it is possible to calculate hyperbolas on which the transmitting device is located."

that determines, on the basis of the differences in times of arrival, the locations of the cellular telephone responsible for the standalone dedicated control channel signals.[91]

The algorithm in the patent that performs this function is described connection with portions Figures 7, and portions 8C-8D which are nicely summarized in the fifth and sixth blocks of Figure 7. The same or equivalent functionality in the GCS has already

In conclusion, it is my opinion that all the elements of claim 1 are literally included in the Geometrix system offered to STC.

E.2.2 CLAIM 2 OF THE '144 PATENT

E.2.2.1 Claim 2 Recitation

A cellular telephone location system as recited in claim 1, wherein said timing signal receiver comprises a global positioning system (GPS) receiver.

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[91] See AND0021416 – AND0021426, "FixMix()"; PX-218, at 13 of 55 noting that the GCS "calculates location estimates based on measurements made by LMU's"; AND_EF134186, noting that "by calculating the difference in arrival time at pairs of cell sites, it is possible to calculate hyperbolas on which the transmitting device is located"; 10/14/06 Deposition Transcript of Alan Li [37] at p. 70, l. 13 – p. 73, l. 15.

[92] *See* Ilan Ziskind and Mati Wax, "Maximum likelihood localization of multiple sources by alternating projection," IEEE Trans. ASSP, Vol. 36, No. 10, pp.1553 – 1560, October 1988; Mati Wax and Ilan Ziskind, "On unique localization of multiple sources by passive sensor arrays," IEEE Trans. ASSP, Vol. 37 No. 7, pp. 996-1000, July 1989; Bin Yang, "Projection approximation subspace tracking," IEEE Trans SP, Vol. 43 No. 1, pp. 95-107, January 1995; Michaela C. Vanderveen, et. al., "Joint Angle and Delay Estimation (JADE) for Multipath Signals Arriving at an Antenna Array," IEEE COMMUNICATIONS LETTERS, VOL. 1, NO. 1, pp.12 - 14, JANUARY 1997; Nilesh Agarwal Leena Chandran-Wadia Varsha Apte, "CAPACITY ANALYSIS OF THE GSM SHORT MESSAGE SERVICE," Indian Institute of Technology Bombay, www.cse.iitb.ac.in/~varsha/allpapers/wireless/ncc03cam.pdf , 2003; John D. Bard and Fredric M. Ham,"Time Difference of Arrival Dilution of Precision and Applications," IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 47, NO. 2, p.521-3, FEBRUARY 1999; K. C. Ho, and Wenwei Xu, "An Accurate Algebraic Solution for Moving Source Location Using TDOA and FDOA Measurements", IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 52, NO. 9, SEPTEMBER 2004.

[93] *See* AND_EF134186 .

E.2.2.2 GEOMETRIX system does perform elements of method Claim 2

The following section describes how the "Geometrix® Wireless Location System" offered to STC literally includes the elements of Claim 2 of the '144 Patent.

E.2.2.3 Claim 2: "A cellular telephone location system as recited in claim 1, wherein said timing signal receiver comprises a global positioning system (GPS) receiver"

Claim 2 is **"A cellular telephone location system as recited in claim 1, wherein said timing signal receiver comprises a global positioning system (GPS) receiver "**

In my opinion, the "Geometrix® Wireless Location System" offered to STC satisfies all of the elements of the claim. I will now explain element by element how the "Geometrix® Wireless Location System" offered to STC infringes on Claim 2.

- **"A cellular telephone location system as recited in claim 1,"**

This element is satisfied by the "Geometrix® Wireless Location System" offered to STC.[94] Since this claim element merely incorporates the elements of claim 1, no analysis is necessary beyond that which I have already explained.

- **"wherein said timing signal receiver comprises a global positioning system (GPS) receiver."**

This element is satisfied by the GPS receiver in each of the Version 2 WLS's/LMU's offered to STC which comprise a global positioning system (GPS) receiver.[95]

In conclusion, it is my opinion that all the elements of claim 2 are literally included in Andrew's "Geometrix® Wireless Location System" offered to STC.

E.3 ANDREW'S AUGUST/SEPTEMBER, 2005 DEMONSTRATION IN ASHBURN – CLAIM 31

E.3.1 CLAIM 31 OF THE '144 PATENT

E.3.1.1 Claim 31 Recitation

A method for determining the location(s) of one or more mobile cellular telephones periodically transmitting signals over one of a prescribed set of reverse control channels, comprising the steps of:

(a) receiving said reverse control channel signals at least three geographically-separated cell sites;

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[94] See infringement opinion for Claim 1 in Section A.E.2.1 above.

[95] See, e.g., PX-115, "GPS" Block; 10/2/06 Deposition Transcript of John Carlson, p. 74, ll. 17-23.

51 frame SDCCH structure illustrated earlier in my report. In any event, the 144 Patent defines "periodic" as "discontinuous," meaning occurring from time to time, which SDCCH transmissions certainly do. Col. 2, ll. 19-22.

I also understand that Andrew may claim that this claim element is not satisfied because the 144 patent is limited to "AMPS" control channels, "analog" control channels, or control channels within a particular band. As fully described earlier, the control channels in an AMPS system are digital, not analog, and the preferred embodiment in Stilp also described digital control channels. The patent cannot be limited to analog control channels.

The patent also specifically states that it is applicable to digital systems that were known at the time (Col. 1, ll. 5-10; Col. 1, ll. 27-30) and since GSM, TDMA and CDMA were known , the patent cannot be limited to control channels that exclude these digital protocols, nor can it be limited to the frequency bands in an AMPS cell phone network. One of ordinary skill would have expected the inventors to describe AMPS more extensively in the patent, or at least mention AMPS, had they intended the patent to be limited to AMPS. Significantly, based on my review of the deposition transcripts of John Webber and Curtis Knight, it appears that neither Mr. Knight nor Mr. Webber have any expertise in AMPS, which suggests that they did not invent an AMPS-specific invention. Their expertise instead appears to be in the area of radio communications.

If the Court should construe the claims in accordance with Andrew's proposed construction of "reverse control channel" then I expect to testify that this claim element is met under the doctrine of equivalents. SDCCH transmissions perform substantially the same function as an AMPS control channel transmissions, in substantially the same way to obtain substantially the same result. The function of both the SDCCH and the AMPS control channel transmissions is to convey digital control information. As mentioned earlier in my report, both AMPS and GSM use digital control channels. Furthermore, both the AMPS control channel transmissions and SDCCH transmissions convey such digital information in substantially the same way--over frequency bands, the difference being that the SDCCH is also defined by time slot. Finally the result is also substantially the same. In the context of cellular network, the result is a call being set up or digital control information otherwise being put to use. In the context of a location system like that claimed in the patent (i.e., like Geometrix), the transmission facilitates cell phone location.

Furthermore, having reviewed the file story the inventors did not disclaim coverage of control channels outside of AMPS.

E.5.3.5 Third Clause of Claim 22: "(b) locating means for automatically determining the locations of said cellular telephones by receiving and processing signals emitted during said periodic reverse control channel transmissions; and"

The third clause of Claim 22 is: **"(b) locating means for automatically determining the locations of said cellular telephones by receiving and processing signals emitted during said periodic reverse control channel transmissions; and"**

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[160] See, e.g., AND0019024 – AND0019038, AND0020896 – AND0021962, AND0022177 – AND0023010; PX-63 at 13 of 55 noting that the GCS "calculates location estimates based on measurements made by LMU's."

[161] *See* Ilan Ziskind and Mati Wax, "Maximum likelihood localization of multiple sources by alternating projection," IEEE Trans. ASSP, Vol. 36, No. 10, pp.1553 – 1560, October 1988; Mati Wax and Ilan Ziskind, "On unique localization of multiple sources by passive sensor arrays," IEEE Trans. ASSP, Vol. 37 No. 7, pp. 996-1000, July 1989; Bin Yang, "Projection approximation subspace tracking," IEEE Trans SP, Vol. 43 No. 1, pp. 95-107, January 1995; Michaela C. Vanderveen, et. al., "Joint Angle and Delay Estimation (JADE) for Multipath Signals Arriving at an Antenna Array," IEEE COMMUNICATIONS LETTERS, VOL. 1, NO. 1, pp.12 - 14, JANUARY 1997; Nilesh Agarwal Leena Chandran-Wadia Varsha Apte, "CAPACITY ANALYSIS OF THE GSM SHORT MESSAGE SERVICE," Indian Institute of Technology Bombay, www.cse.iitb.ac.in/~varsha/allpapers/wireless/ncc03cam.pdf , 2003; John D. Bard and Fredric M. Ham,"Time Difference of Arrival Dilution of Precision and Applications," IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 47, NO. 2, p.521-3, FEBRUARY 1999; K. C. Ho, and Wenwei Xu, "An Accurate Algebraic Solution for Moving Source Location Using TDOA and FDOA Measurements", IEEE TRANSACTIONS ON SIGNAL PROCESSING, VOL. 52, NO. 9, SEPTEMBER 2004.

[162] *See* AND_EF134186 .

E.5.3.6 Fourth Clause of Claim 22: "(c) database means for storing location data identifying the cellular telephones and their respective locations, and for providing access to said database to subscribers at remote locations"

The fourth clause of Claim 22 is: **"(c) database means for storing location data identifying the cellular telephones and their respective locations, and for providing access to said database to subscribers at remote locations."**

In conclusion, it is my opinion that all the elements of claim 22 are included in the combination of Andrew's "Geometrix® Wireless Location System" supplied to Saudi Arabia and STC's cellular network.

E.5.4 CLAIM 31 OF THE '144 PATENT

E.5.4.1 Claim 31 Recitation

A method for determining the location(s) of one or more mobile cellular telephones periodically transmitting signals over one of a prescribed set of reverse control channels, comprising the steps of:

(a) receiving said reverse control channel signals at least three geographically-separated cell sites;

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[163] See, e.g., PX-63 at 33 of 55, "Latitude," "Longitude," "Identity"; PX-236 – PX-240.

[164] 11/21/06 Deposition Transcript of Iris Inbar, p. 28, l. 1 – p. 31, l. 24.

(b) processing said signals at each cell site to produce frames of data, each frame comprising a prescribed number of data bits and time stamp bits, said time stamp bits representing the time at which said frames were produced at each cell site;

(c) processing said frames of data to identify individual cellular telephone signals and the differences in times of arrival of said cellular telephone signals among said cell sites; and

(d) determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals.

E.5.4.2 GEOMETRIX system does perform all elements of method Claim 31

The following section describes how the Geometrix installed at the STC network operates and how during Andrew's demonstrations and tests in Saudi Arabia it performs all of the steps of method Claim 31 of the '144 Patent.

E.5.4.3 First Clause of Claim 31: "A method for determining the location(s) of one or more mobile cellular telephones periodically transmitting signals over one of a prescribed set of reverse control channels, comprising the steps of:"

The first clause of Claim 31 is: **"A method for determining the location(s) of one or more cellular telephones each initiating periodic signal transmissions over one of a prescribed set of reverse control channels, comprising the steps of:"**

This element is literally satisfied by Andrew during operation of Geometrix installed at the STC network at the demonstration(s) or tests performed by Andrew Corporation.[165] The method was for determining the location of a cellular telephone.[166] The cellular telephone phone initiated periodic signal transmissions over a standalone dedicated control channel.[167] In fact Andrew specifically tested and demonstrated the SDCCH location functionality in Saudi Arabia.

I understand that Andrew my claim that this element is not satisfied because SDCCH transmissions are not "periodic" within the meaning of the 144 Patent. In fact, SDCCH transmissions are transmitted at regular intervals, as exemplified by the recurring 51 frame SDCCH structure illustrated earlier in my report. In any event, the 144 Patent defines "periodic" as "discontinuous," meaning occurring from time to time, which SDCCH transmissions certainly do. Col. 2, ll. 19-22.

I also understand that Andrew may claim that this claim element is not satisfied because the 144 patent is limited to "AMPS" control channels, "analog" control channels, or control channels within a particular band. As fully described earlier, the control channels in an AMPS system are digital, not analog, and the preferred embodiment in

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[165] See, e.g., PX-236; PX-238; PX-240.

[166] See, e.g., PX-236; PX-238; PX-240.

[167] See, e.g., 10/17/06 Deposition Transcript of Andrew Corporation by Joseph Kennedy, pp. 224-231; PX-236; PX-238 ; PX-240.

Exhibit E

DRAFT TRANSLATION

English Translation of Japanese Laid-open Patent Application

(19) JAPANESE PATENT OFFICE (JP)
(12) Official Gazette for Kokai (Laid-Open) Patent Applications (A)
(11) Japanese Patent Application Kokai (Laid-Open) Publication No.: H3-239091
(43) Kokai (Laid-Open) Publication Date: October 24, 1991
Number of Claims: 1
Request for Examination: None submitted
(Total of 6 pages in the original Japanese)

(51) Int.Cl.[5]	Ident. Symb.	JPO File No.
H04Q 7/04	C	7608-5K

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(54) MOVING BODY RADIO COMMUNICATION APPARATUS

(21) Application Filing No.: H2-36652
(22) Application Filing Date: February 16, 1990
(72) Inventor: Mitsunori KONO, Mitsubishi Electric Corporation, Telecommunications Systems Laboratory, 1-1 Ofuna 5-chome, Kamakura City, Kanagawa Prefecture
(71) Applicant: Mitsubishi Electric Corporation, 2-3 Marunouchi 2-chome, Chiyoda-ku, Tokyo
(74) Agent: Masuo OIWA, Japanese Patent Attorney (and 2 other individuals)

SPECIFICATION

1. Title of the Invention

Moving Body Radio Communication Apparatus

2. Claims

Moving body radio communication apparatus, characterized in being equipped with control channel transceivers that transmit to and receive from a moving body control signals for controlling radio communication with a moving body having the capacity to transmit and receive using control channels that are specifically allocated, and a traffic channel transceiver means that transmit and receive signals for communication and control with respect to a moving body using traffic channels that are specifically allocated, and a plurality of base stations possessing control means that control the aforementioned means and a shared channel reception means that receives position locating signals from a moving body using shared channels that are specifically allocated, and a switching station that receives data in the aforementioned position locating signals and that transmits and receives communications signals and control signals between the control means, with there being a connection between a telecommunications network and the control means of the above-mentioned bases, and a position locating means that locates the position of a moving body, being connected to the switching station.

3. Detailed Description of the Invention

Field of Industrial Use

This invention relates to a moving body radio communication apparatus possessing a switching station and a plurality of base stations, and in particular, this invention relates to a moving body radio communication apparatus possessing a moving body position locating function.

Prior Art

FIG. 4 shows a configuration of a prior art automobile telephone system, as described, for example in *BSTJ*, January 1979, Vol. 58, No. 1, Page 158, Fig. 4, where ***1*** is a switching station; ***3a – 3n*** are base stations; ***4a – 4n*** are base station antennas; ***5*** is mobile equipment located in an automobile or the like; ***8*** is an antenna for mobile equipment; ***11a – 11n*** are control devices for the base stations ***3a – 3n***; ***12a – 12n*** are control channel transceivers that transmit and receive signals for the control channels allotted for each of the base stations ***3a – 3n***; ***13a – 13n*** are locator receivers; ***14a – 14n*** are traffic channel transceivers that transmit and receive signals for traffic channels allotted for each of the base stations ***3a – 3n***; ***15a – 15n*** are antenna-sharing devices; ***21*** is a junction point between the switching station ***1*** and the public telecommunications network; ***22a – 22n*** are telecommunication circuit junction points between the switching station ***1*** and the base stations ***3a – 3n***; ***23a – 23n*** are data circuit junction points; ***25a – 25n*** are junction points between the control channel transceivers ***12a – 12n*** and the control devices ***11a – 11n***; ***26a – 26n*** are junction points between the locator receivers ***13a – 13n*** and the control devices ***11a – 11n***; ***27a – 27n*** and ***28a – 28n*** are junction points between the traffic channel transceivers ***14a – 14n*** and the control devices ***11a – 11n***; and ***29a – 29n***, ***30a – 30n***, and ***31a – 31n*** are junction points between the control channel transceivers ***12a – 12n***, the locator receivers ***13a – 13n***, and the traffic channel transceivers ***14a – 14n***, respectively, and the antenna-sharing devices ***15a – 15n***.

Next, the operation is described. The control channel transceivers ***12a – 12n*** of the base stations ***3a – 3n*** are modulated by reporting signals that include identifier signals from the base stations ***3a – 3n***, and the carrier waves of the respectively differing radio frequencies are continuously transmitted. The mobile equipment ***5*** scans all of the designated control channels, fixes to the one with the largest reception electrical field, and stands by. At this point, suppose that a call was made to a specific mobile equipment ***5*** at the junction point ***21*** connecting to the public telecommunications network. The switching station ***1*** issues a command to the base station ***3a – 3n*** to call the specified mobile equipment ***5***, and when this is received, the control device ***11a – 11n*** radiates a call signal in the space from the antenna ***4a – 4n*** via the control channel transceivers ***12a – 12n*** and the antenna-sharing devices ***15a – 15n*** to call the mobile equipment ***5***. The mobile equipment ***5*** stands by to receive the strongest electrical field, for example, from the base station ***3a***, and receives the call signal from the base station ***3a***, and immediately transmits a response signal. The base station ***3a*** which receives the response signal allots an empty traffic channel of the traffic channel transceivers ***14a***, establishing a state of voice communication. The switching station ***1*** establishes a switching connection between the

traffic channel designated by the base station ***3a***. If the voice communication quality of the current traffic channel degrades, then the control device ***11a*** relies on the measurement of the electrical field of the current traffic channel by a nearby base station, e.g., the base station ***3b*** – ***3e***, via the switching station ***1***. Measurement of the electrical field is carried out by the locator receiver ***13b*** – ***13e*** of the base station ***3b*** – ***3e***, and supposing that the electrical field of the base station ***3c*** is the largest, then the switching station ***1*** will issue a command to the mobile equipment ***5*** via the current traffic channel to switch to an idle traffic channel of the base station ***3c***, thereby switching and connecting the circuit of the public telecommunications network to a new traffic channel. Furthermore, if there is a call from the mobile equipment ***5***, the operation is the reverse of that described above. If either the public telecommunications network or the mobile equipment ***5*** terminates, then the switching station ***1*** and the control device ***3c*** terminate operation.

Problems to be Solved by the Invention

The prior art automobile telephone system had a constitution as described above, and was suited for wireless radio analog transmission, and when migrating to digital transmission (TDMA format), the distance between the base station ***3a*** – ***3n*** and the mobile equipment ***5*** had be measured, and equipment was needed for that.

This invention was devised to solve the above-mentioned problem, and has as its object to make it possible to measure the distance between a base station and a moving body, and also to produce a moving body radio communication apparatus that can locate the position of a moving body.

Means for Solving These Problems

The moving body radio communication apparatus of this invention is provided with a plurality of base stations that possess a shared channel reception means that receives position locating signals from a moving body using shared channels that are allotted jointly, a switching station that receives data in the form of these position locating signals, and a position locating means that is connected to the switching station, inputs the above-mentioned data, and locates the position of a moving body.

Operation of the Invention

In this invention, a moving body transmits position locating signals using shared channels allotted jointly to the base stations, the shared channel transceivers of the base stations receive these position locating signals and transmit the data to the switching stations, the switching stations transmit this data to a position locating means, and the position locating means locates the position of the moving body.

Working Examples

A working example of this invention is described below with drawings. **FIG. 1** shows a configuration of a moving body position locating apparatus in accordance with this working

example, where reference numeral *2* is a position location calculating device, *16a – 16n* are shared channel receivers provided within the base stations *3a – 3n*, which transmit to and receive from a shared channel *12* allotted jointly to the base stations *3a – 3n*. Reference numeral *24* is a junction point between the switching station *1* and the position location calculating device *2*; *32a – 32n* are junction points between control devices *11a – 11n* and the shared channel receivers *16a – 16n*; *33a – 33n* are junction points between the shared channel receivers *16a – 16n* and antenna-sharing devices *15a – 15n*. The rest of the configuration is identical to that of **FIG. 4**.

Next, the operation is described. The control channel transceivers *12a – 12n* are modulated by announcing signals that contain identifier signals of the base stations *3a – 3n*, and the carrier waves of the respectively differing radio frequencies are continuously transmitted. The mobile equipment *5* scans all of the designated control channels, fixes to the one with the largest reception electrical field, and stands by. For example, if the mobile equipment *5* is positioned within the zone of the base station *3a*, it waits for signals from the control channel transceiver *12a*. At this point, if there is a request to locate the position of a specific mobile equipment *5* at the junction point *21* connecting to the public telecommunications network, then the exchange station *1* issues a command to the base stations *3a – 3n* to call and locate the position of the mobile equipment *5*. When this is received, the control device *11a – 11n* radiates a call signal in the space from the antenna *4a – 4n* via the control channel transceivers *12a – 12n* and the antenna-sharing devices *15a – 15n* to call the mobile equipment *5*. The mobile equipment *5* stands by to receive the signal with strongest electrical field from among the radiated position locating call signals radiated by the base station *3a*, using the control channel, and when this position locating call signal is received, it immediately transmits a response signal, switching to a shared channel and emitting a position locating signal which is a burst digital signal. The base station *3a* that receives the response signal reports to the switching station *1* that the mobile equipment *5* is within its own zone. Furthermore, when some of the shared channel receivers *16a – 16n* of the base stations *3a – 3n* receive the position locating signal from the mobile equipment *5*, the absolute time or the relative time when the position locating signal arrives is determined by correlation detecting the unique word contained therein, and reports to the switching station *1* via the control devices *11a – 11n* data such as the difference in arrival time of position locating signals with respect to the various base stations *3a – 3n*. The base station *1* forwards these data to the position location calculating device *2*, and the position of the mobile equipment *5* is calculated. In this case, if there are many [illegible] values of the shared channel receivers *16a – 16n*, and if the density is suitable, the accuracy of the position locating can be quite high.

Next, suppose that a call is made to a specific mobile equipment *5* at the junction point *21* connecting to the public telecommunications network. In this case, the switching station *1* issues a command to the base station *3a – 3n* to call the specified mobile equipment *5*. When this is received, the control device *11a – 11n* radiates a call signal in the space from the antenna *4a – 4n* via the control channel transceivers *12a – 12n* and the antenna-sharing devices *15a – 15n* to call the mobile equipment *5*. The mobile equipment *5* stands by to receive the signal with the strongest electrical field from among the call signals, for example, standing by with the control channel of the base station *3a*, receives the call signal from the base station *3a*, and immediately transmits a response signal. The base station *3a* which receives the response signal allots an idle traffic channel of the traffic channel transceivers *14a*, establishing a state of voice

communication. The switching station *1* establishes a switching connection between the traffic channel designated by the base station *3a*. At this point, if the voice communication quality of the current traffic channel degrades, then the control device *11a* issues a command to the mobile equipment *5* to transmit a position locating signal using a shared channel via the currently used traffic channel. When this command is received, the mobile equipment *5* switches to a shared channel and transmits a position locating signal, returning to the current traffic channel. When the shared channel receivers *16a – 16n* receives this position locating signal, it determines the arrival time from the unique word therein, and reports these data to the switching station *1* via the control devices *11a – 11n*. The switching station *1* reports these data to the position location calculating device *2*, establishing the position of the mobile equipment *5*. In accordance with these position location results, if, for example, the mobile equipment *5* is within the zone of the base station *3c*, the switching station *1* posts an inquiry to the control device *11c* of the base station *3c* as to an idle traffic channel, and issues a command to the mobile equipment *5* to switch to an idle traffic channel of the base station *3c*, thereby switching and connecting the circuit of the public telecommunications network to a new traffic channel. It should be noted that the junction points *22a – 22n* are used for voice communication signals, and the junction points *23a – 23n* are used for data or control signals. If a call originates from the mobile equipment *5*, the operation is the reverse of that described above. If either the public telecommunications network or the mobile equipment *5* terminates, then the switching station *1* and the control device *11c* terminate operation.

FIG. 2 shows a configuration of the shared channel receivers *16a – 16n*, and *41* is a high-frequency filter, *42* is a high-frequency amp, *43* is a primary mixer, *44* is a synthesizer that generates a primary local frequency, *45* is a primary intermediate frequency filter, *46* is a primary intermediate frequency amp, *47* is a secondary mixer, *48* is a crystal oscillator that generates a secondary local frequency, *49* is a secondary intermediate frequency filter, *50* is a secondary intermediate frequency amp, *51* is a detector/decoder, *52* is a unique word detection circuit, *53* is a time measurement circuit, *54* is a standard clock, and *55* is a control circuit.

In the configuration of **FIG. 2**, when a high-frequency signal modulated by a position locating signal is input to the junction point *33* connecting to the antenna-sharing devices *15*, it is selected by the high-frequency filter *41*, amplified by the high-frequency amp *42*, mixed with the output of the synthesizer *44*, using the primary mixer *43*, and converted to a primary intermediate frequency. After that, it is selected by the primary intermediate frequency filter *45*, amplified by the intermediate frequency amp *46*, mixed with the output of the secondary local frequency crystal oscillator *48*, using the secondary mixer *47*, and converted to a secondary intermediate frequency. Moreover, it is selected by the secondary intermediate frequency filter *49*, amplified by the secondary intermediate frequency amp *50*, and decoded to a position locating signal using the detector/decoder *51*. The position locating signal includes a unique word on the order of 14 bits, and the unique word detection circuit *52* detects the correlation with the original unique word, and when the correlation reaches a peak, the time measurement circuit *53* is triggered. The standard clock *54* is an ultra-high precision clock, and the time measurement circuit *53* measures the absolute time of the above-mentioned trigger, and reports it to the switching station *1* from the control circuit *55* via the control device *11*. Furthermore, conversely, the time of the standard clock *54* is corrected by the switching station *1*. Since the unique word correlation detection is accurate to a level of 1/50 bit, if the bit rate of the unique

word is 50 kbps, then the precision is (1 sec + 50 kbps) x 1/50 = 0.4 [illegible], so the precision in locating the mobile equipment ***5*** is on the order of 120 m. If the bit rate is 500 kbps, then the location precision is improved by about 12 m.

FIG. 3 shows a configuration of a moving body radio communication apparatus of a second working example of this invention, and ***7a – 7k*** are position locating stations, ***8a – 8k*** are antennas thereof, ***17a – 17k*** are control devices, ***18a – 18k*** are shared channel receivers, and ***34a – 34k*** are contact points between the shared channel receivers ***18a – 18k*** and the antennas ***8a – 8k***. The rest of the configuration is identical to that of **FIG. 1**.

In the configuration of **FIG. 3**, the position locating stations ***7a -7k*** are provided to increase the accuracy of locating the position of the mobile equipment ***5***, and when the mobile equipment ***5*** transmits a position locating signal using a shared channel, the arrival time is measured, and the data is reported to the switching station ***1***. The switching station ***1*** transmits the data from the base stations ***3a – 3n*** and the data from the position locating stations ***7a – 7k*** to the position location calculating device ***2***, causing the position of the mobile equipment ***5*** to be calculated. The rest of the configuration is identical to that of **FIG. 1**.

It should be noted that in the above working examples, with regard to the shared channels, only the receivers ***16a – 16n*** were provided, but even if these were transceivers, the same results would be obtained, and moreover, messages could be left with the mobile equipment ***5***.

Advantageous Effects of the Invention

In accordance with the invention as described above, it is possible to locate the position of a moving body and determine the distance between a base station and a moving body and digitally transmit with a radio circuit by providing a car telephone system with base stations and a shared channel receiving means, and connecting a moving body position location means to a switching station.

4. Detailed Description of the Drawings

FIG. 1 and **FIG. 2** are schematic diagrams of a moving body radio communication apparatus of the first working example and of a shared channel receiving means. **FIG. 3** is a schematic diagram of working example 2 of this invention. **FIG. 4** is a schematic diagram of a prior art device.

1 .... Switching station
2 .... Position location calculating device
3a – 3n .... Base stations
4a – 4n, 6 .... Antennas
5 .... Mobile equipment
11a – 11n .... Control devices
12a – 12n .... Control channel transceivers
14a – 14n .... Traffic channel transceivers
16a – 16n .... Shared channel receivers

Exhibit F

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TruePosition, Inc.	)	
	)	
Plaintiff/	)	
Counterclaim-Defendant,	)	**C.A. No. 05-747 (SLR)**
	)	
v.	)	
	)	
Andrew Corporation,	)	
	)	
Defendant/	)	
Counterclaim-Plaintiff.	)	
	)	

EXPERT REPORT OF BRIAN G. AGEE, PH.D., P.E.
RESPONSE TO DR. DAVID GOODMAN'S REPORT ON THE VALIDITY OF U.S. PATENT NO. 5,327,144

Claim 22 Language	Missing in Kono Under		
	Andrew Claim Constructions	TruePosition Claim Con-structions	Ordinary & Customary Meaning
(c) database means for storing location data by identifying the cellular telephones and their respective locations, and for providing access to said database to subscribers at remote locations.	Missing	Missing	

Table 3-4: Summary of Opinions Related to Kono and Claim 31 of the 144 Patent (Detailed Opinion in Subsection 3.3.1.4)

Claim 31 Language	Missing in Kono Under		
	Andrew Claim Constructions	True-Position Claim Con-structions	Ordinary & Customary Meaning
31. A method for determining the location(s) of one or more mobile cellular telephones			
periodically transmitting signals			
over one of a prescribed set of			
reverse control channels,			
comprising the steps of:			
(a) receiving said reverse control channel signals at at least three geographically-separated cell sites;	Missing	Missing	
(b) processing said signals at each cell site to produce			Missing
frames of data			
each frame comprising a prescribed number of			
data bits			
and			
time stamp bits,			
said time stamp bits representing the time at which said frames were produced at each cell site.			
(c) processing said frames of data			Missing
to identify			
individual cellular telephones			
and			
the difference in times of arrival of said cellular telephone signals among said cell sites;			
and			
(d) determining, on the basis of said times of arrival differences, the locations of the cellular telephones responsible for said cellular telephone signals.	Missing	Missing	

Table 3-5: Summary of Opinions Related to Kono and Claim 32 of the 144 Patent (Detailed Opinion in Subsection 1)

Claim 32 Language	Missing in Kono Under		
	Andrew Claim Constructions	TruePosition Claim Con-structions	Ordinary & Customary Meaning
32. A method as recited in claim 31, further comprising the steps of			
storing, in a database, location data identifying	Missing	Missing	
the cellular telephones			
and			

Claim 32 Language	Missing in Kono Under		
	Andrew Claim Constructions	TruePosition Claim Constructions	Ordinary & Customary Meaning
their respective locations,			
and			
providing access to said database to subscribers at remote locations.	Missing	Missing	

3.3.1.1 Detailed Opinions Relating to Kono and Claim 1 of the 144 Patent

A summary of my conclusions regarding the teachings of Kono to one having ordinary skill in the art at the time and the limitations in Claim 1 of the 144 Patent is set forth in Table 3-1 above. My opinions can be summarized as follows:

- Kono fails to teach reception and provision of *reverse control channel* cellular telephone baseband signals as part of its invention. The "common channel receiver" that performs this function in Kono instead receives and provides the [baseband] *position location signal* transmitted from the mobile over the "common channel" defined in Kono. This common channel is *not* a control channel under both the Andrew Claim Constructions and the TruePosition Claim Constructions.
- Kono fails to teach mobile initiation of signals used for position location. Instead, position location signals are always transmitted in response to a call from the base station transceiver.
- Kono fails to teach a timing signal *receiver* receiving a timing signal common to all cell sites.
- Kono fails to disclose or teach "a sampling subsystem … for sampling [a] baseband signal" of any sort. Figure 2 of Kono instead presents a subblock *51*, referred to as a *Wave detector* in the Figure, and a *detector/decoder* in the text, that does not implement a sampling function.
- Kono fails to disclose or teach "formatting of the sampled baseband signal … into frames of digital data comprising *data bits*" and time stamp bits. Kono only teaches reporting of the mobile unit zone location from the nearest (strongest) base station, and reporting of timing data derived from the position location to the exchange office.
- Kono fails to disclose or teach means for processing said data frames from cell site systems (base station transceivers in Kono) to generate a table of any sort, much less the processing means defined by both the Andrew Claim Constructions and the TruePosition Claim Constructions.
- Kono fails to disclose or teach *any* means for determining, on the basis of times of arrival differences, the locations of cellular telephones, much less the specific locating means defined by both the Andrew Claim Constructions and the TruePosition Claim Constructions.

My detailed opinions supporting these conclusions are provided below.

<u>Kono fails to teach reception and provision of *reverse control channel* cellular telephone baseband signals</u>

Kono fails to teach reception and provision of *reverse control channel* cellular telephone baseband signals, i.e.,

> "… a baseband convertor operatively coupled to said antenna for receiving cellular telephone signals transmitted over a reverse control channel by said telephones and providing baseband signals derived from the cellular telephone signals;" (144 Patent, Col 20, ll 10-14)

as an expresss or inherent part of its invention. Dr. Goodman and I both agree that the corresponding device to the "baseband convertor …" in the Kono application would be contained within the common channel receiver *16a-16n* in Figure 1 (first embodment) and Figure 4 (second embodiment) of Kono, specifically, the processing steps comprising blocks 41-50 in Figure 2 of Kono, and possibly comprising block 51 of Kono (denoted a "Wave detector" in Figure 2, and a "detector/decoder" in the text describing that block). In particular, on page 13 of his report, Dr. Goodman writes (highlights mine):

> "Claim 1 of the '144 patent also includes a 'baseband converter' for receiving the periodic transmissions on the reverse control channels. The corresponding device in the Kono application is a shared channel receiver at each base station (*16a-16n*)

Comparison of Figure 1 and Figure 4 (prior art) in Kono reveals that the *only* differences between the prior art and the invention in Kono is the replacement of the "Locator Receiver *13a-13n*" in Figure 4 with the "Common Channel Receiver *16a-16n*" in Figure 1. Moreover, in the second embodiment of Kono's invention (Figure 3), position location bureaus that comprise *only* common channel receivers are taught, i.e., the control channel (and voice channel) transceivers are dropped.

Moreover, the position location signals in Kono are not expressly or *inherently* control signals, under either Andrew's or TruePositions Claim Constructions. The only attribute of the position location signals that are taught by Kono is the 14-bit Unique Word (UW). Neither the structure of the Unique Word (bit sequence, relationship of bit sequence to channel, or relationship of bit sequence to individual users), nor the modulation format of the Unique Word, nor any other component of the position location signal, is taught in Kono. In fact, Kono fails to state whether the Unique Word is unique to the *user*, or unique to the *common channel*, i.e., if the position location signal is identical for every user that accesses the channel.

Based on definitions of "Unique Word" (UW) bit sequences encountered in other cellular air interfaces, the UW is likely meant to be a bit pattern that is unique to the channel. For example, the Personal Handy Phone System (PHS), a microcellular telephone system developed in 1989 principally by NTT Laboratories and standardized by the Association of Radio Industries and Businesses (ARIB) as RCR STD-28, defines 16 bit and 32 bit Unique Words for traffic-bearing communication physical slots, synchronization bursts (defined as communication physical slots in RCR STD-28) and control physical slots, on both the PHS downlink (reverse link) and uplink (forward link) (see for example, PHS Association of Radio Industries and Businesses Standard version 2, RCR STD-28, Figure 4.2.23.7, page 88, 1995). Given that Mistubishi Electric, Ltd. (the assignee for Kono) was a member of ARIB and was actively involved in the development and deployment of PHS in the mid-1990's, it is likely that Kono was using the Unique Word in the same sense employed in PHS.

At the same time, the Unique Word does not constitute "signaling information" in any customary and ordinary sense. In particular, the *Telecommunications: Glossary of Telecommunication Terms* Federal Standard 1037C ("FS-1037C"), published 23 August 1996, provides the following definition of *signaling*:

> **signaling: 1**. The use of signals for controlling communications. **2.** In a telecommunications network, the information exchange concerning the establishment and control of a connection and the management of the network, in contrast to user information transfer. **3.** The sending of a signal from the transmitting end of a circuit to inform a user at the receiving end that a message is to be sent. *[citations omitted]*

Using this definition, the customary and ordinary definition of *signaling information* would be control information that is provided by the telecommunications network, to set up and manage the network, inform user receiver that a message is to be sent, or otherwise control communications of the network.

The Unique Word meets none of these criteria. The UW is not used for controlling communications in Kono; any commands sent from the base transceiver station due to analysis of the UW are sent over the prior art control channel using the control channel transceiver *12a-12n*. The UW is never used to establish and control communications. The UW does not constitute "user information" of any sort; it is a known sequence. And the UW is never used to inform the base transceiver station that a message is to be sent — in the one instance taught in Kono in which such a message *is* sent (TruePosition Kono Translation, pg.TPI0067421, Col. 1, ll 40-47), Kono teaches that the message is sent on a separate channel from the position location signal

> "… it [the mobile unit] immediately transmits a response and switches to the common channel and transmits a position location signal …" (TruePosition Kono Translation, pg.TPI0067421, Col. 1, ll 44-46)

Lastly, because there is ample precedent for incorporation of Unique Words' into synchronization bursts, traffic (voice) channels, etc., as seen in the PHS standard, and because Kono teaches no other aspect of the position location signal, the position location signal is not inherently a control channel signal.

Dr. Goodman makes no attempt to argue that the common channel is a control channel, other than providing a tortuous (and incorrect) argument that they possess a "many-to-one" property that is also possessed by control channels. In fact, *any* reverse wireless channel theoretically possesses a "many-to-one" property, as multiple mobile units that are designed to operate in the cellular network could use that channel to simultaneously transmit to a single base transceiver station if not prevented from doing so. Among other features, the *signaling information* transmitted over the control channel is generally designed to prevent that from happening. In any event, Dr. Goodman's argument fails to satisfy (or even address) the definition of "control channel" proposed under the Andrew or TruePosition Claim Constructions.

> "… when the common channel receivers *16a-16n* receive this position location signal, the arrival time of a unique word therein is measured, and this data is reported to the exchange office *1* via the control devices *11a-11n*. The exchange office *1* in turn sends this data to the position location computer *2*, which locates the position of the mobile unit 5. (TruePosition Kono Translation, pg. TPI067421, Col. 2, ll 46-48)

At the end of the description of the second embodiment (shown in TruePosition Kono Translation, Figure 3), Kono teaches (highlighting mine):

> "When the mobile unit *5* transmits a position location signal on the common channel, its arrival time is measured and that data is reported to the exchange office *1*. The exchange office *1* transfers the data from the base transceiver stations *3a-3n* and the data from the position location bureaus *7a-7k* to the position location computer device *2*, where the position of the mobile unit *5* is computed." (TruePosition Kono Translation, pg. TPI0067422, Col 2, ll 25-32)

These are the only passages in Kono in which "means for determining location" are discussed.

Kono is mute on the algorithm used to compute that location. In particular, the "method of least squares" is not inherent to position location; less computationally complex location methods based on non-least-squares metrics (e.g., "taxicab" metric) can be used and may have advantages in applications of clear interest to Kono, e.g., identification of changes in base station zones occupied by mobile units. Consequently, Kono fails to expressly or inherently anticipate these means under the Andrews Claim Constructions.

Similarly, neither the fifth and sixth blocks of Figure 7, nor the top four elements of Figure 8D, nor the text accompanying those blocks in TruePosition's Claim Constructions, are taught by Kono. Moreover, the "filtering" operation shown in the fifth block of Figure 7 and taught in Col 13, ll 58-59 of the 144 Patent, the linearized weight least-squares technique shown in the first element of Figure 8D and taught in Col 18, ll 17-18 and line 31 of the 144 Patent, or the alternating LAT-LON search method shown in the last other three of the top four elements of 8D and taught in Col 18, ll 13-34 of the 144 Patent are not inherent to a position location algorithm based on times of arrival differences. Consequently, Kono fails to expressly or inherently anticipate these means under the TruePosition Claim Constructions.

Dr. Goodman completely fails to provide any argument teaching how the "means for location" taught by Kono are related to Andrew's (or TruePosition's) proposed Claim Constructions.

3.3.1.2 Detailed Opinions Relating to Kono and Claim 2 of the 144 Patent

A summary of my conclusions regarding the teachings of Kono to one having ordinary skill in the art at the time and the limitations in Claim 1 of the 144 Patent is set forth in Table 3-2 above. My opinions supporting these conclusions are provided below.

First, as discussed in the passage in Subsection 3.3.1.1 entitled "Kono fails to teach a timing signal receiver receiving a timing signal common to all cell sites," Kono fails to teach a timing signal receiver of any sort, much less a timing signal common to all cell sites, much less a GPS receiver. In particular, the method for timing control taught by Kono is not inherently implemented using a GPS disciplined clock. Nothing in Kono teaches a similar receiver, nor does any sort of correction applied from an exchange office inherently teach such a receiver.

My opinion is consistent with opinions expressed by the 144 patent inventors. In ll 1,377-1,388 of Dr. Webber's deposition, Dr. Webber provides the following additional information at the end of the exchange listed abover on analog-to-digital conversion (highlighting mine):

> Dr. Webber: "… So, another additional piece of equipment required in the overall conversion process from our radio frequency to a lower frequency band and then subsequently converting to digits is an accurate clock, an accurate time reference. So an ancillary piece of equipment for this project was a disciplined GPS oscillator, which provided signals with the required phase and time stability for both the down-conversion and the digitization. It's not strictly necessary. It's just convenient and relatively inexpensive to achieve the required performance."

In ll 2,404-2,417 of Dr. Webber's deposition, Dr. Webber and Andrew's counsel have the following additional exchange on this matter (highlighting mine):

> *Ms. Waldron: "Could you describe exactly what a timing signal receiver does?"*
>
> Dr. Webber: "A timing signal receiver provides, in some fashion, a relative time reference in order to identify the exact time at which the signal was received at each cell telephone site. That — in the system it was

> GPS receivers at each site. One could use some other synchronizing signal that's widely disseminated, such as a LORAN signal, or one could put rubidium clocks at each site, which keep accurate time to a microsecond per month. But some means must be provided of identifying exactly the time at each cell telephone tower and relating those times to each other."

Dr. Goodman fails to address inherency of the timing signal receiver in his report. Instead, on page 14 of his report, he states that correction of the clock using a GPS clock was known in 1993. However, this observation fails to satisfy the criteria for inherency of a GPS receiver given Kono, since Kono mentions nothing about a GPS clock and timing correction could be provided without a GPS receiver, as noted by Dr. Webber above.

3.3.1.3 Detailed Opinions Relating to Kono and Claim 22 of the 144 Patent

A summary of my conclusions regarding the teachings of Kono to one having ordinary skill in the art at the time and the limitations in Claim 22 of the 144 Patent is set forth in Table 3-3 above. My opinions supporting these conclusions are provided below.

- Kono fails to disclose or teach any locating means for automatically determining the locations of cellular telephones. Instead, it teaches a "command-respond" approach in which position location only occurs after a command (position location call) is sent from either the exchange office (based on unexplained criteria) or the base transceiver station.
- Kono fails to disclose or teach location by receiving and processing signals emitted during reverse control channel transmissions. Instead, it locates the telephones using signals emitter received and processed on common channel that is not a control channel under either Andrew's or TruePosition's Claim Constructions.
- Kono fails to disclose or teach any database means for storing location data, much less the specific database means defined by both the Andrew Claim Constructions and the TruePosition Claim Constructions.

My detailed opinions supporting these conclusions are provided below.

Kono fails to disclose or teach any locating means for automatically determining the locations of cellular telephones.

Kono fails to disclose or teach any locating means for automatically determining the locations of cellular telephones, under either the Andrew or TruePosition Claim Constructions. Instead, it teaches a "command-respond" approach in which position location only occurs after a command (position location call) is sent from either the exchange office (based on unexplained criteria) or the base transceiver station (based on degradation of the mobile signal quality on the mobile traffic channel, as taught in the TruePosition Kono Translation, pg. TPI0067421, ll 34-38).

Andrew's Claim Construction for "locating means …" directs me to "automatically determine the location of cellular telephones (function) … using a general purpose computer programmed with the algorithm disclosed in the 144 patent using least squares." As explained in the passage in Subsection 3.3.1.1 entitled "Kono fails to disclose or teach any means for determining the locations of cellular telephones," Kono fails to expressly or inherently disclose or teach any structure or algorithms for determining the location of the cellular telephones. Thus, Kono also fails to teach a "least squares algorithm" of any sort, such as the algorithm taught in the 144 Patent. As this passage also explains, the least squares algorithm taught in the 144 Patent is not inherent to position location, and can be replaced by other algorithms, e.g., algorithms based on non-least-squares metrics, or least-squares algorithms that do not employ linearized-weight-least-squares iterations in their formulation, based on other implementation requirements such as processor complexity. Consequently, Kono fails to expressly or inherently anticipate locating means under the Andrews Claim Constructions.

Similarly, TruePosition's Claim Construction for "locating means …" directs me to evaluate this element of Claim 22 based on Kono's teaching of the first six blocks in Figure 7, Figures 8A-8C, and the top four elements of Figure 8D of the 144 Patent, and the text accompanying those Figures. As is also explained in the passage in Subsection 3.3.1.1 entitled "Kono fails to disclose or teach any means for determining the locations of cellular telephones," Kono fails to expressly or inherently anticipate "locating means …" under this Claim Construction, for the same reasons given in that passage.

Dr. Goodman fails to address either of these Claim Constructions in rendering his opinion. Moreover, since the "shared [common] channel receiver and its associated blocks are not part of the exchange office, and (as explained in the passage above) Kono fails to teach any operations in the position locating device, his argument cannot be interpreted in light of these Claim Constructions.

Kono fails to disclose or teach location by receiving and processing signals emitted during reverse control channel transmissions

As explained in the passage in Subsection 3.3.1.1 entitled "Kono fails to teach reception and provision of reverse control channel cellular telephone baseband signals," Kono does not process "periodic reverse control channel transmissions" in the common channel receiver in any event, but instead processes the position location signals, which are (as explained in that passage) not control channel transmissions under either Andrew's or TruePosition's Claim Constructions.

Dr. Goodman again provides contradictory information in his report, by attempting to imply that

> "the elements of the Kono application that perform this function [receiving and processing signals emitter during said periodic reverse control channel transmissions]

are

> "the shared [common] channel receivers in the base stations"

in the fourth paragraph on page 14 of his report, and then, in his applicable summary table on page 17 of his report, he states (highlighting mine):

Claim Language	**Present in Kono**	**Kono Disclosure**
…		
equipped to receive signals sent by multiple mobile cellular telephones	Yes	Control channel transceivers *12a-12n*
each initiating periodic signal transmission	Yes	"a moving body transmits position locating signals using shared channels,"
over one of a prescribed set of reverse control channels	Yes	"*12a-12n* are control channel transceivers that transmit and receive signals for the control channels allotted for each of the base stations *3a-3n.*"
…		

That is, Dr. Goodman appears to acknowledge that the "reverse control channels" are the channels connected to the control channel transceivers 12a-12n in Kono, but then appears to imply that the signals sent over these control channels, and received and processed by the control channel transceivers 12a-12n, are the position locating signals. However, on page 14 of his report, he also acknowledges that these signals are both (a) sent over the shared [common] channels and (b) processed by the shared [common] channel receiver at the base transceiver station.

Again, given his contradictory statements here, I can not ascertain his true opinion is on this matter. However, he advances no argument anywhere in his report explicitly stating an opinion that the position location signals are control signals, or that the shared [common] channel is a control channel.

Kono fails to disclose or teach any database means for storing location data

Kono fails to disclose or teach any database means for storing location data, much less the specific database means defined by both the Andrew Claim Constructions and the TruePosition Claim Constructions.

In regards "database means for storing location data …", Andrew's Claim Constructions direct me to consider only whether Kono teaches (highlighting mine):

> "storing location data identifying the cellular telephones and their respective locations, and for providing access to the database to subscribers at remote locations"

using

> "a database or local disk storage device containing the telephone number corresponding to each cellular telephone and a terminal coupled to the database via (1) modem and telephone line, or (2) radio communication providing access to the database and user."

However, as I explain in the passage in Subsection 3.3.1.1 entitled "Kono fails to disclose or teach means for processing said data frames from cell site systems, to generate a table," Kono fails to teach either a table of individual cellular telephone sig-

Exhibit G

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TRUEPOSITION, INC.,

Plaintiff/Counterclaim-Defendant

vs. CA No. 05-00747-SLR

ANDREW CORPORATION,

Defendant/Counterclaim-Plaintiff

VIDEOTAPED DEPOSITION OF DR. DAVID GOODMAN

New York, New York

Monday, January 15, 2007

Reported by:
Adrienne M. Mignano
JOB NO. 190791

invalidity report; is that correct?

A. That's correct.

Q. When did you first come to believe that the '144 patent is invalid?

A. I think early in November.

Q. Sitting here right now, do you, in fact, believe that the '144 patent is invalid?

A. Yes.

Q. Based on what?

A. Based on my understanding of the patent and based on my analysis of a prior art reference that I referred to in my expert report.

Q. Did you come to an understanding of what the claims of the '144 patent meant in connection with your opinion that the patent is invalid?

MS. WALDRON: Objection. Legal conclusion.

A. Yes.

Q. For each one of the claim elements of the claims of the '144 patent?

A. Of the asserted claims, yes.

Goodman

Q. Do you have an understanding of how patent claims are interpreted from a legal standpoint?

MS. WALDRON: Objection. Legal conclusion.

A. It's been explained to me. So I have an engineer's understanding, perhaps not a lawyer's understanding. It's been explained to me by lawyers.

Q. What's your engineer's understanding of how the patent claims are interpreted?

A. My understanding is that they are interpreted as they would have been understood by someone of skill in the art at the time that the patent application was filed. And that the person of skill in the art would gain this understanding by reading the claims, and referring to their meaning within the context, technical context of the patent, and that, in some cases, that would be insufficient to gain an understanding, and that there would be other considerations, particularly what the inventors said in the

remainder of the patent, and also what the inventors told the patent office when they were trying to get the patent office to issue the patent.

Q. Did you apply your understanding of how patent claims are construed in rendering your invalidity opinion?

A. Yes.

Q. Dr. Goodman, I would like to show you what I suppose we should mark, just to be safe, Exhibit 300.

It's an expert report of Dr. David Goodman on the invalidity of 5,237,144. Let me know when the court reporter has shown you Plaintiff's Exhibit 300.

(Plaintiff's Exhibit 300, Expert Report of Dr. David Goodman of the Invalidity of 5,237,144, marked for identification, as of this date.)

A. I have Exhibit 300.

Q. Do you recognize Exhibit 300?

A. Yes, it's a copy of the invalidity report that we've been speaking about.

Q. Could you turn to page 5 of the

invalidity report, Exhibit 300, and let me know when you're there?

A. I have page 5.

Q. Do you see the last full paragraph of page 5 where it says "I understand the claims are construed"?

A. Yes.

Q. Could you read that paragraph into the record?

A. Of course.

"I also understand that court has not yet construed claims, claim terms in this case --

Q. I'm sorry, Dr. Goodman --

A. The last full paragraph?

Q. Yes, please.

A. I beg your pardon.

"I understand the claims are construed according to their plain and ordinary meaning to one of ordinary skill in the art. I understand the same claim construction must be used for both an infringement analysis and an invalidity analysis. I understand claims cannot be

A. Excuse me, Mr. Milcetic, before I answer your question, I want to point out that figures in the patent application aren't included in Exhibit 466.

Q. Were they included in the version that you prepared in rendering your report?

A. Yes.

Q. I believe this is the only version that we have.

MS. WALDRON: Do you mean that there were figures in that or that you also relied on the original Japanese figures?

THE WITNESS: That's true. I relied on the figures. Anyway, I had -- it says Figure 1, and I had a copy of Figure 1 that I attached to this, and I suppose maybe the translator didn't attach it.

Q. Would it be helpful if I gave you the figures in the original Japanese translation?

A. Yes, please.

MS. WALDRON: I believe there are

Goodman

also some in the report.

THE WITNESS: Thanks.

A. For the moment, Mr. Milcetic, Ms. Waldron showed me that I incorporated it in my report, so --

Q. Go ahead.

A. I don't need you to give me Figure 1 right now. Maybe all of them that I referred to, if you remember that.

What's the question, please?

Q. Referring to page 15 of your report, where in the Kono disclosure is a cellular telephone location system for determining the location of multiple mobile telephones disclosed?

A. Okay.

And my answer is in the sentence in the right-hand column of row 1 that appears on page 3 of the translation, the working example of this invention is described below, and then it says Figure 1 shows a configuration of a moving body position location apparatus.

Q. And it's your interpretation that

the moving body refers to a cellular telephone?

A. That's my interpretation.

Q. The next block down on page 15 of your report, do you see that?

A. Yes.

Q. The phrase is "each initiating periodic signal transmission over one of a prescribed set of reverse control channels comprising."

Do you see that?

A. Yes.

Q. Where in the Kono disclosure is that claim element disclosed?

A. It says on page 3, at the beginning of the section that's headed operation of the invention, it says, "in this invention, a moving body transmits position locating signals using shared terminals."

Q. Is it your understanding that shared channels are the same as a prescribed set of reverse control channels?

Q. So is it correct that you're not really saying that the '144 patent isn't valid, so much that it may be invalid under some interpretation of the patent?

MS. WALDRON: Objection. Mischaracterizes.

A. What am I supposed to say yes or no to?

Q. Let me ask a different question.

A. You're putting words into my -- that I didn't write into this report. Maybe I should read how I described the situation.

Q. The question I have is: Is it your opinion that the '144 patent is invalid?

A. Yes.

Q. Is it your opinion that the '144 patent is invalid even if Andrew's product is

not encompassed -- is not encompassed within the '144 patent claims?

MS. WALDRON: Object to the form.

Q. Let me repeat it.

Is it your opinion that the '144 patent is invalid even if Andrew's geometrics is not encompassed within the '144 patent claims?

MS. WALDRON: Objection.

A. I don't have an opinion about that.

Q. As to whether under that set of circumstances, the '144 patent is invalid?

A. I haven't done that analysis at all.

Q. What is it about the phrase shared channels in Kono that makes you believe that it is similar or that it corresponds to anything in Andrew's product?

MS. WALDRON: Object to the form. Compound.

Q. Specifically stand-alone dedicated

channels you mean?

A. Yes.

Q. In Andrew's product?

A. Yes.

Q. What makes you think that in Kono, the shared channels are being transmitted in two directions?

A. Well, because Kono disclosing a transceiver at the cell site, or whatever he calls the cell site, and transceiver includes transmitter and receiver.

Also, it seems that Kono technology allocates this shared channel to one cell phone at a time. Just as Andrew -- just as a

Q. Is it your understanding that the shared channels in Kono are channels that are emitted as part of the normal operation as part of at telephone location system?

MS. WALDRON: Objection. Vague.

A. I think they are emitted. The

shared channels are emitted.

Would you read the question again?

(Record read)

Q. Actually, I'll rephrase it.

Is it your understanding that the position locating signals transmitted over the shared channels are signals that are sent in the context of a normal cellular telephone system?

MS. WALDRON: Objection. Vague.

A. I suppose normal -- I'm not sure what normal means in this question. If you could explain it further, I can answer it certainly.

Q. Is it your understanding that the position locating signals in Kono are part of the signals that are sent in any cellular telephone system as part of its everyday operation.

MS. WALDRON: Objection. Vague.

A. Yes.

MS. WALDRON: While there is no question pending, are we still breaking for lunch at 12:30?

Goodman

according to certain cellular telephone standards; is that right?

A. Yes.

Q. Does Kono disclose that signal format?

Q. Is it fair to say that both Kono and Andrew do not use that signal format?

MS. WALDRON: Objection. Form.

Q. Then does it follow that Kono doesn't use that signal format as well?

MS. WALDRON: Objection to the form.

A. I think I answered that as well. In the same way that Andrew uses it or doesn't use it, Kono -- I think I explained

that before lunch.

Q. And you also testified that Kono discloses that element to the same extent as Andrew practices that element, correct?

A. Yes.

MS. WALDRON: Objection.

Q. Doesn't it follow then that Kono doesn't then disclose that element?

Q. And what is the basis for that opinion?

A. The basis for that opinion is that the shared channel in the Kono application

has similar properties to the stand-alone dedicated control channel that I understand is TruePosition's. It conforms to the prescribed set of reverse control channels, because, as you know, I have done the infringement analysis as well as the invalidity analysis, so I'm aware of how TruePosition interprets this and I think they are compelled to say. I know you have had different experts for the two things. I think if you ask Dr. Gottesman, he would have to say, oh, yeah, it's in Kono too because of the way he found it in Andrew. I don't agree with him.

Q. When did you first learn how TruePosition contends that Geometrix infringes the patent?

A. I suppose it was in the summer when Mr. Parks told me about the lawsuit.

Q. When did you start learning about how Geometrix works in terms of its operation?

A. I think it was in October, towards the middle or end of October.

Q. Do you know when you first formed an opinion that the '144 patent was invalid if the claims are construed to cover Geometrix?

A. Yes.

Q. When?

A. I think the first week in November. Within that time frame.

Q. Do you remember when you first came to the opinion that Geometrix doesn't infringe the '144 patent?

A. I'm trying to synchronize these dates here, but I think early in December I came to the opinion that Dr. Gottesman didn't prove that Geometrix infringes the '144 patent, so that's the opinion I want to offer to the court.

I was asked by Kirkland & Ellis to find out whether Dr. Gottesman proved it, and it's my opinion that he did not.

Q. Is it your understanding that the Kono disclosure discloses an AMPS cellular telephone system?

A. Sorry, I haven't been asked for

Goodman

Q. I noticed in your invalidity report, Exhibit 300, at the end of the report, there is a listing of material to be considered in forming your opinion relating to the invalidity of the '144 patent, correct?

A. Yes.

Q. And I also noticed that nothing in that report, the invalidity report, none of those materials seem to relate to the operations of Geometrix.

Am I right about that?

MS. WALDRON: Objection. Form. Assumes a fact.

A. I agree with you about -- well, I'd like to see. I just don't remember what's in references 5, 6 and 7 in Andrew, documents prepared by Andrew Corporation. Those are, I think, the only ones that might say something about how their Geometrix system works. I don't remember what's in them.

Q. Did you, for purposes of rendering your invalidity report, did you consider the operation of Geometrix?

Goodman

A. Yes.

Q. What were the sources that you used?

A. To my recollection, there is one source that I didn't list here, and that was a phone conversation with Mr. Kennedy, who is an employee of Andrew.

Q. When was the phone conversation?

A. If I recall correctly, I spoke to him before I wrote the invalidity report. I just don't know.

Q. Do you think to make your invalidity report accurate, it would be worth correcting it to add the Joseph Kennedy conversation?

A. I think so. If that's true, I would like to ask Ms. Waldron because she participated in the phone conversation if it actually occurred.

MS. WALDRON: I'm not allowed to testify right now.

A. As I recall now, I think that would improve the report to say that I had a phone conversation with Mr. Kennedy.

Q. Would you prefer to make that change?

A. Yes.

Q. Please go ahead since we're keeping a master copy of what the report is reflecting your opinions today.

A. Yes.

Q. Just for the record, you're writing on Exhibit 300, correct?

A. That's correct. I'm writing on page 3 of Exhibit B.

Q. Apart from Ms. Waldron and Mr. Kennedy, was there anyone else on the conversation?

A. I don't remember. There might have been another Kirkland attorney, but I don't know.

Q. What exactly did you discuss?

MS. WALDRON: Objection. Vague.

A. As best as I can recall about that particular conversation, I think he kind of talked me through the -- talked me -- explained step by step how Geometrix system finds out where a mobile phone is. Finds the

location of a mobile phone.

Q. Apart from -- let me step back.

What did Ms. Waldron say on the conversation?

MS. WALDRON: Objection. Vague. Overbroad.

A. I don't recall that she said anything. I was visiting Kirkland & Ellis' office at the time, and as I said, Ms. Waldron was there, maybe Mr. Parks.

Q. Where were you exactly?

A. At the Kirkland & Ellis office in Chicago.

Q. About when did the conversation take place?

A. Early November.

Q. Other than the early November conversation between yourself, Joe Kennedy and Ms. Waldron, did you have any other source of understanding of how Geometrix works at the time that you rendered your invalidity report?

A. I don't recall any other sources.

Q. At that time, had you looked at any

Geometrix source code?

A. No.

Q. At that time, had you looked at any technical documentation relating to the operation of Geometrix?

A. I don't think so.

Q. Let me explain where I'm going with this.

As I understand it, correct me if I'm wrong, you were -- your opinion in your invalidity report in summary is that the Kono disclosure discloses each element of the claims and corresponds to each element of the '144 patent claims to the same extent that Geometrix does, correct?

A. Yes, almost correct.

Maybe not to the same extent, but if Geometrix conforms to the claims, then Kono conforms to the claims, and I don't know how to measure extent. It seems like a binary thing, it either conforms or it doesn't.

Q. It follows then at the time that you rendered your invalidity opinion, you

must have had some working knowledge of the Geometrix product, correct?

A. Yes.

Q. To render that opinion?

A. Yes.

Q. And that understanding of the Geometrix product at the time that you rendered your invalidity report would have been based, at least in part, on the conversation between you and Mr. Kennedy in early November, correct?

A. Yes.

Q. And thus far, you haven't been able to recall any other sources of information, right?

MS. WALDRON: Objection. Misstates.

A. At the moment, I don't recall.

Q. Do you want to think about it and think of some other potential sources?

A. Well, I was just going to explain my answer a little more. That I have, by now I have a pile of documents relating to the Geometrix system, and I have read a lot of

them, and I just don't remember when I received them and when I read them relative to preparing this report. But I think the information that I used was what I heard Mr. Kennedy tell me about.

Q. When Mr. Kennedy explained the operation of the Geometrix system to you, did he go through each element of the claims and discuss how Geometrix relates to those elements?

MS. WALDRON: Objection. Vague. Assumes a fact.

A. As best as I can recall from two, two-and-a-half months ago from a phone conversation, he really didn't analyze the '144 patent. You know, I asked him questions, tell me how it works, he told me how it worked, and we didn't get very far into the patent claims. I just wanted to know how does your stuff find out where a cell phone is located.

Q. Next claim element on page 16 of your invalidity report is timing signal receiver.

Do you see that?

A. Yes.

Q. It's your opinion that the timing signal receiver limitation in claim 1, the second row of the chart on claim 16, is disclosed in Kono?

A. Yes.

Q. What's the basis of that understanding?

A. My basis for that understanding is that there is a high precision clock within each of the shared channel receivers labeled 54 in the Kono patent, and that this -- the high precision clocks at all of the base stations are corrected by the switching station.

Q. Is it your understanding that the Kono disclosure discloses a GPS clock?

A. That's not my understanding. I don't subscribe to that.

Q. Is it your belief that Kono discloses a GPS receiver?

A. It's my belief that Kono does not say anything about a GPS receiver. Sorry,

digital microprocessor. There are all forms of computers. I don't know about a laptop or a desktop.

So that would be part of it, and the remainder of it would be some sort of communication resources for transferring information to and from the switching station.

Q. The next claim element on page 16 is "means for processing said frames of data from said cell site systems."

Do you see that?

A. Yes.

Q. Is it your opinion that that claim term is disclosed in Kono?

A. It's my opinion that if somebody found it in the Geometrix equipment, they would be compelled to say that it is also in Kono.

Q. In your view, does Kono disclose a means for processing that's in some way similar to a means for processing in Geometrix?

MS. WALDRON: Objection. Vague.

A. May I look at my claims construction that are in these exhibits?

Q. Certainly. I believe your claim construction is Exhibit --

A. So somewhere I defined means for processing. So it might help me to --

Q. Yes. I think it is 463 or 464 that you did that.

A. Yes, I see something on 463. I'd like also to look at one of the other exhibits, which was Andrew's proposed claim construction from November 22nd.

Q. That's Exhibit 301.

A. 301. Thank you. I'm going to refer to Exhibit 301.

Just to be absolutely certain, would you read the question, please, just so I know what I'm answering.

(Record read)

Q. I can clarify if you like.

A. I want to make sure I'm answering the right question. It wasn't that it was unclear.

Q. Under your construction today, you

just looked it up --

A. It's actually 465, I think.

Q. In Exhibit 465. Does Kono disclose the means for processing limitation?

A. It's --

MS. WALDRON: Objection. Vague. Calls for legal conclusion.

A. It's my opinion that someone of skill in the art who finds that claim element in Geometrix equipment would be compelled to say that it also exists in Kono.

Q. What's the basis for your opinion?

A. The basis for my opinion is this statement in Exhibit 466 that something reports to the switching station data such as the difference in arrival time of position locating signals with respect to the different base stations.

Q. The construction that you laid out this morning for means for processing encompassed Figure 6A and Figure 7, correct?

A. Yes.

Q. If I went through those figures on a block by block basis, would you be able to

find a disclosure in Kono that corresponds to those figures?

MS. WALDRON: Objection. Compound. Overbroad.

A. It's my opinion that if somebody performed this exercise with respect to the Geometrix equipment, and came to the conclusion that you suggest, that all of those things exist in the Geometrix equipment, they would also have to say that it exists in Kono.

Q. Is the disclosure in Kono, does that essentially describe in your view the Geometrix equipment?

MS. WALDRON: Objection. Vague. Ambiguous.

A. I haven't performed this analysis, but I'll just stop there. I haven't advised anyone whether Geometrix has to pay royalties to Kono if that's what you're asking me. That might be another infringement.

Q. When you were rendering your invalidity report, did anyone explain to you how means plus function claims elements were

construed?

A. I think so. I have heard explanations before I got involved in this lawsuit, and I assume -- I would imagine that I heard the same explanations, but I don't remember specifically.

Q. What is your understanding about means plus function claim elements are construed?

A. My understanding is that in order to construe the claims, you have to read the claim itself and find out what function is being claimed, and then read the patent specification to find out the structure that performs that function.

Q. Is it your understanding that the structure can be found in the prior art if an equivalent of the structure is disclosed?

MS. WALDRON: Objection. Legal conclusion. Compound.

A. I have no understanding of whether that's true or not.

Q. How about with respect to infringement?

Goodman

MS. WALDRON: Objection. Form. Legal conclusion.

A. Would you state a complete question about infringement?

Q. With respect to infringement, is it your understanding that means plus function elements are construed to cover the corresponding structure plus equivalents?

MS. WALDRON: Objection. Calls for a legal conclusion.

A. I understand that the claim may be drafted in means plus function format. I understand that for an accused product to literally meet a means plus function claim limitation, an element in the accused product must, one, perform the same function recited in the means plus function claim limitation, and, two, use the same structure disclosed in the patent specification or its equivalent structure to perform the recited function.

I understand that an accused structure may be equivalent to the disclosed structure in the patent specification if it performs the same function in the same way to

Goodman

achieve the same result.

Q. When you were doing your validity analysis for Kono, did you also understand that means plus function claim elements encompass corresponding structure and equivalent structure?

MS. WALDRON: Objection. Legal conclusion. Assumes a fact.

A. Would you read the question again?

(Record read)

A. I didn't use that legal rule in my validity analysis. I understood what it meant in terms of infringement, but I didn't use it in my validity analysis.

Q. Correct me if I'm wrong, your testimony is that this means for processing limitation is disclosed in Kono to the same extent that one would claim it's found in Geometrix; is that correct?

A. Again, I won't subscribe to same extent, either it's found there or not. I don't know what an extent of finding it. So it's my opinion that if somebody were to analyze the Geometrix technology and apply

this claim construction and then find in the Geometrix technology that the claim limitation is met, that same person would be compelled to say that it is also met in Kono. Or that Kono discloses it.

Q. But that's not necessarily because the algorithms in Kono and in Geometrix are the same; is that right?

MS. WALDRON: Objection. Vague. Form.

A. As I've said before, Geometrix -- sorry, as I've said before, Kono discloses a large universe of algorithms, and it is my opinion that those algorithms are included in the patent and also in Geometrix.

Q. Are there any flow charts in Kono?

A. I don't remember seeing any flow charts.

Q. Is there any code appended to the Kono disclosure?

A. I don't remember seeing that either.

Q. Do you know whether the word software is mentioned in Kono?

A. I don't recall seeing the word software in Kono.

Q. Is the word algorithm mentioned in Kono?

A. I don't recall seeing that.

Q. How do you know that if the means for processing limitation is found in Kono, then it must also be --

MR. MILCETIC: Scratch that.

Q. How do you know that if the means for processing limitation is found in Geometrix, then it must also be found in Kono?

MS. WALDRON: Objection. It assumes a fact.

A. I know that because Kono discloses using data such as the difference in arrival time in order to calculate location, and the means for processing limitation also requires the same words for virtually differences in times of arrival. So that is the basis of -- and then someone recognized that there are a lot of algorithms for using differences of times of arrival for determining location.

Q. I believe for this means for processing element, you construed it to include some structure that included Figure 7 of the patent; is that right?

A. Yes.

Q. Could we turn to Figure 7 of the patent. I believe that's Exhibit 462. And let me know when you're there.

A. Exhibit 462, yes. And anyplace in particular? I found the patent.

Q. Yes, Figure 7. Let me know when you're there.

A. Thanks.

I have Figure 7.

Q. This is part of the means for processing in your view, right?

A. Yes.

Q. The first block, do you see what it says?

A. Yes.

Q. Can you read that into the record?

A. Yes. The first block says, "Receive one frame of data from all cell sites."

to provide a construction of that claim limitation as well, right?

A. Yes.

Q. Is it your opinion that the means for determining limitation is disclosed in Kono?

A. It's my opinion that if somebody finds this means for determining limitation in Geometrix technology, that person would be compelled to say that it also exists in Kono.

Q. I believe this morning your construction of the means for determining limitation included some aspects of figure 8A through 8B, right?

A. I'll have to check.

The construction I had to offer this morning had to do with the structure for that claim element, was found in the location calculation section of the '144 patent, which spans three columns, column 16, 17 and 18, and excludes two lines in 19, and excludes two lines in column 16.

Q. And column 16 through 18 of the '144 patent include a description of a lease

square difference algorithm; is that right?

MS. WALDRON: Objection.

Overbroad.

A. That's correct.

Q. Does Kono disclose a lease square difference algorithm?

A. I would say so, yes.

Q. Where?

A. Essentially Kono says on page 4, he should say the switching station forwards difference in arrival time of position locating signals to the position locating device and the position of the mobile equipment is calculated. So I think there are many techniques for performing this calculation at the time that the application for the '144 patent was filed, and that would include these square difference techniques.

Q. Tell me where you're reading that.

A. From the Kono patent?

Q. Yes.

A. Yes, of course. I'm sorry.

Looking at page 4, and I'm looking at the middle paragraph, and I'm looking at

essentially the last six or seven lines in the middle paragraph, and my statement to you a few minutes ago rearranged the words in those, in there, but essentially I think I conveyed the same information that they did, that this does, but changing base station one to switching station one.

Q. And just to be clear, which part of -- could you read into the record for me which part of page 4 of the Kono translation that you're relying on discloses the lease square difference algorithm?

A. Of course.

Would you like me to read what Kono wrote or would you like me to paraphrase it in a way that seems more --

Q. Go ahead and paraphrase it.

A. -- better suited to answering your question.

Q. Go ahead.

A. Okay.

So first of all, I'm going to have to change base station to switching station. So the next to last sentence in the middle

that somebody practicing the technology in the patent performs a complex algorithm that includes lease squares difference computation, and it's my opinion that it doesn't perform the algorithm that includes lease square difference estimation, but I can't state that it does everything else except the lease square difference, because I really don't think that's true. I think that's what you're asking me to do. If it didn't say lease squares difference would everything else be there, and I don't agree with that.

Q. What I'm getting at more, Dr. Goodman, is a double standard in my mind. Correct me if I'm wrong. What you're sitting here telling me is the Kono disclosure disclosing this locating means element based upon a statement that locations are calculated and that's it?

A. Yes.

Q. And then when we go to infringement, you're telling me that Geometrix doesn't perform the locating means

calculation because it has to have lease square difference and everything else within the four corners of three columns of what the patent discloses. Correct?

A. Yes.

Q. Do you see where the disconnect is, where there may be a double standard here?

MS. WALDRON: Objection to the form. Calls for a narrative.

A. I really want to draw a picture.

Q. Go ahead.

A. Can I have a sheet of paper?

Q. This is going to be marked as Exhibit 468. It's a blank piece of paper. Let me know when the court reporter has shown you Exhibit 467.

(Plaintiff's Exhibit 468, Blank Piece of Paper, marked for identification, as of this date.)

A. So what I'm trying to say is that Kono discloses a lot of things. All of them are included in the '144 patent. If somebody thinks that Geometrix is -- I don't think Geometrix is at all included in the '144

patent. But if somebody did say that Geometrix was included in the '144 patent, I would have to say the '144 patent is included in Kono. So it's a picture that keeps coming into my mind.

I think in order to show that the '144 patent infringes Kono, it's not necessary that Kono just be limited to the things within the '144 patent. It could have a lot of other things too.

So I don't think that's a double standard. I think it's -- it seems logical to me, and completely fair.

Q. Well, I think perhaps the assumption --

A. And I put these dotted lines because I haven't formed an opinion as to whether Geometrix infringes Kono. I'm just sure that it is separate from the '144 patent.

Q. If I understand your position correctly, one of the assumptions that you're making is when Kono discloses position location calculating device, it's disclosing

every possible algorithm that there may have been at that time for doing a positions calculation?

A. Yes.

Q. Just by simply saying that; is that correct?

A. Yes.

Q. And then I take it you would agree if there was a piece of evidence in this case among the hundreds of thousands of documents that have been exchanged that Geometrix calculates it too would be included and be encompassed by the location means in the patent?

MS. WALDRON: Objection. Legal conclusion. Misstates.

A. I think -- it's very hypothetical, and I haven't performed an analysis as to whether Geometrix infringes Kono. But I think it is possible under your hypothesis that someone would find that Geometrix infringes Kono after doing that type of analysis that you're requiring.

Q. What I'm asking is very simply, if

Goodman

patent is valid.

MS. WALDRON: I was going to ask if we can take a break soon.

Q. Is it your impression that Kono is a patent?

A. Well, Kono is a patent application, and somehow I'm looking for all of the -- I wouldn't -- my opinion wouldn't change if it was a published paper or an equipment manual. But somehow I'm just using the language of patent infringement because it's more immediate in my mind, so it's just a document that was available to someone of skill in the art when the '144 patent application was filed.

MR. MILCETIC: We can take a break.

THE VIDEOGRAPHER: We're off the video record at 4:10 p.m.

(Thereupon, a recess was taken, and then the proceedings continued as follows:)

THE VIDEOGRAPHER: Back on the video record at 4:22 p.m.

Goodman

BY MR. MILCETIC:

Q. Dr. Goodman, when we left we were talking about the claim charts at pages 16, 17 -- actually page 16, and now I would like you to turn to page 17 of claim 22 of your invalidity report.

A. Yes.

Q. It's Exhibit 300.

A. Yes.

Q. It's a ground base cellular telephone system serving a plurality of subscribers possessing mobile cellular telephones propriety.

A. Yes, I see that.

Q. That's present in Kono; is that right?

A. Yes.

Q. How do you know?

A. In the prior art of the Kono patent on pages 2 and 3, he describes what I might call generic cellular telephone system, and the location technology is embedded in that.

Q. How do you know that the cellular telephone system in Kono serves a plurality

of subscribers?

A. We're talking about -- so the telephone system that's described as an example, it says BSTJ January 1979, and I think anyone of skill in the art would recognize that the reason for using cellular technology and dividing a service area into cells is in order to be able to provide telephone service to a large population.

Q. That's what cell telephone systems are for?

A. Yes, it's distinguished over prior mobile communications systems.

Q. What would the prior mobile communications systems have been?

A. Oh, there were cartel phones that are a bit like police radios or things like that, where there is a big tower, transmission tower on the rooftop or something, and it communicates with all of the phones. It has a certain numbers of channels and the number of people who can use the system is restricted to the number of physical channels. In the cellular system,

we talked about reuse, where you can have the same physical channels used by different people in different parts of the metropolitan area.

Q. The next limitation on page 17 is at least three cell sites?

A. Yes.

Q. Your opinion is that that's disclosed in Kono, correct?

A. Yes.

Q. Because Kono discloses base stations, correct?

A. Yes.

Q. And in your view, cell sites encompass base stations?

A. Yes.

Q. Well, the next claim limitation on page 17 is equipped to receive signals sent by multiple mobile cellular telephones. This is still claim 22.

Do you see that?

A. Yes.

Q. Your opinion is that that's disclosed in Kono, right?

Goodman

A. My opinion is that if somebody finds that disclosed -- if somebody finds the Geometrix is receiving signals from multiple mobile cellular telephones, they would have to admit that Kono technology is also receiving signals sent by multiple mobile cellular telephones.

Q. How would one have to interpret the claims to say that Geometrix has equipment for receiving signals sent by multiple mobile cellular telephones?

MS. WALDRON: Objection. Legal conclusion. Speculation.

A. It's a very difficult question to answer because I think it is impossible. I can try to stretch my mind to think of some weird interpretation.

Q. So it's impossible to or very difficult to say that this claim limitation equipped to receive signals encompasses Geometrix, correct?

A. I really haven't done that analysis. I suppose I could.

Q. Well, let me ask you this. Let's

get back to basics here for a moment.

Your position here is that if Geometrix is encompassed by the claims, then Kono invalidates the '144 patent, right?

A. Yes, that's right. If someone puts Geometrix in the '144 circle, they are really stuck with Kono.

Q. Can you give me any interpretation under which of the claims, under which Geometrix infringes the '144 patent?

MS. WALDRON: Objection. Legal conclusion. Speculation.

A. I can't do this sitting here. I don't know how much time Dr. Gottesman tried -- spent trying to do that and he completely failed, so I think that even if I went off for a month, if TruePosition hired me, I would be hard pressed to do any better than Dr. Gottesman did.

Q. So you don't know of any construction sitting here right now under which Geometrix infringes the '144 patent; am I correct?

MS. WALDRON: Same objection.

Goodman

Legal conclusion. Misstates.

A. Right, absolutely correct.

Q. Doesn't it follow then that there is no construction then of the '144 patent that you can envision under which Kono validates the '144 patent?

MS. WALDRON: Objection. Legal conclusion. Confusing.

A. I disagree with that. I keep going back to my picture that says just because it's impossible to put Geometrix in this '144 circle, doesn't mean that it is impossible to put Kono outside the '144 circle.

Q. When you rendered your report on invalidity, did you compare the claims of the '144 patent to Kono?

A. Yes.

Q. Did you compare the claims of the '144 patent interpreted so as to include Geometrix in the scope to Kono in rendering that opinion?

MS. WALDRON: Objection. Vague. Legal conclusion.

A. Formed an opinion as to how

Goodman

Q. Why don't you write out --

A. Write out the answer to the question. Can I ask the reporter to read it to me slowly and I'll write down what I said. Do I need another exhibit?

Q. Yes, why don't we give you an exhibit.

(Plaintiff's Exhibit 469, Blank Piece of Paper, marked for identification, as of this date.)

Q. The court reporter has just handed you a blank sheet of paper labeled 469, and I'd like to you write down the interpretation of the patent that you disagree with that would encompass Geometrix and at the same time show that Kono invalidates the '144 patent under that interpretation.

MS. WALDRON: Objection. Compound. Overbroad. Legal conclusion.

A. Any particular claim or all of the asserted claims?

Q. Claim one.

MS. WALDRON: Objection.

Compound. Overbroad. Legal conclusion.

Q. Is there an easier claim that you can deal with more simply?

A. I'm not trying to save work. So if you prefer claim 1, I'll work on that one. I think it is more detailed than some of the others.

Q. Why don't we do claim 22.

A. Okay, that might take less time.

MS. WALDRON: Same objections for the record. Compound. Overbroad. Legal conclusion.

A. Essentially you're asking me to do Dr. Gottesman's job, so can I refer to his report, because I assume that's what he was asked to do by TruePosition?

Q. You rendered an invalidity report, and each time that I asked you for the basis for why it is that you think it is invalid, you keep telling me, well, if the claims encompass Geometrix, then the patent is invalid.

A. Right.

Goodman

Q. What I want to know is the precise assumptions that you're making, the precise construction under which that invalidity opinion becomes relevant to this case.

MS. WALDRON: Objection. Argumentative.

A. Is your answer that I consult Gottesman since he probably spent a long time doing that?

Q. Sure, you can.

A. Can I have a copy of his report?

Q. Sure.

What if I gave you TruePosition's constructions, would that be what you're looking for?

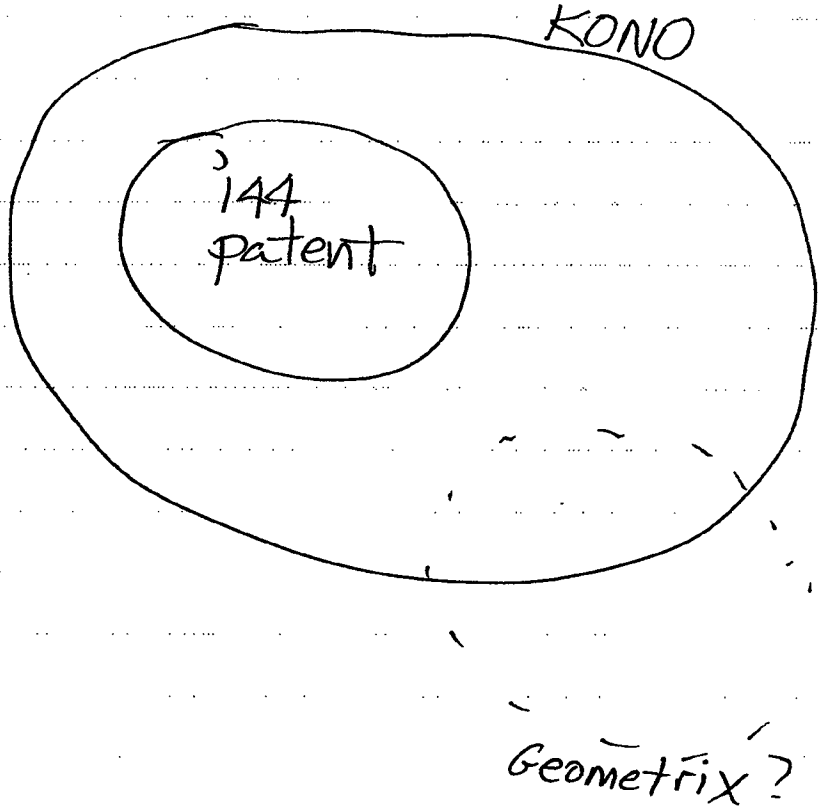
A. I think you're asking me to find some way of proving -- find some claims construction in which I can prove Geometrix infringes the '144 patent.

Q. And that Kono invalidates the '144 patent.

A. Yes.

Q. I'm just simply trying to find out the basis for your opinion in the invalidity

Exhibit H


KONO
'144 patent
Geometrix?

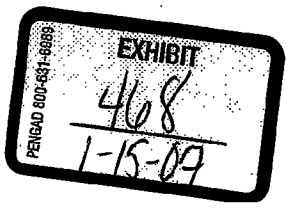


EXHIBIT
468
1-15-09
PENGAD 800-631-6989

Exhibit I

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

TRUEPOSITION, INC.,	)	
	)	
PLAINTIFF/	)	
COUNTERCLAIM- DEFENDANT,	)	
	)	
	)	
v.	)	CA NO. 05-00747-SLR
	)	
ANDREW CORPORATION,	)	
	)	
DEFENDANT/	)	
COUNTERCLAIM-PLAINTIFF.	)	

REBUTTAL EXPERT REPORT OF DR. DAVID J. GOODMAN ON THE NONINFRINGEMENT OF U.S. PATENT NO. 5,327,144

C. THE ASSERTED DEPENDENT CLAIMS

Claim 2 states that the timing signal receiver in Claim 1 is a global positioning system receiver.

Claim 32 states that the method in Claim 31 further comprises storing in a database cellphone identifiers and locations and providing access to the database to subscribers at remote locations.

V. THE ANDREW TECHNOLOGY IS SUBSTANTIALLY DIFFERENT FROM THE TECHNOLOGY IN THE '144 PATENT

Although the technology claimed in the '144 patent and the Andrew Geometrix system both use transmissions from cellphones to determine the geographical coordinates of the cellphones, they differ in many fundamental ways as described in the following paragraphs. Section VI contains a detailed response to Dr. Gottesman's infringement analysis.

A. GSM SYSTEM PROPERTIES

The GSM system does not include a "prescribed set of reverse control channels" as required by each claim of the patent. Reverse control channels are logical channels in an AMPS analog cellular system. In every AMPS system there is a prescribed set of physical channels that are used for reverse control channels. A reverse control channel carries information in one direction (from cellphone to base station). It is shared by many cellphones.

The GSM system also has one-way logical channels shared by many cellphones. They are referred to as Random Access Channels (RACH). *See also* WIRELESS PERSONAL COMMUNICATIONS, p. 276 ("AMPS reverse control channel" is a "counterpart" to RACH channel in GSM). However, they are not used by Andrew products to locate cellphones. Transmissions on the GSM SDCCH (stand alone dedicated control channels) differ fundamentally from the transmissions on reverse control channels required by the patent. They do not use a prescribed set of physical channels. They carry information in both

directions between cellphones and base stations and as the name implies a SDCCH is *dedicated* to a single cellphone while it is in use.

B. LOCATING INDIVIDUAL OR MULTIPLE CELLPHONES

By contrast, the technology in the '144 patent monitors a reverse control channel and thus receives information from several cellphones. It uses information in messages transmitted on the AMPS reverse control channel (see page 104 of my textbook) to identify the cellphone that transmitted the message. This information is essential to the location procedures in the patent, which require the central site system to process information received from three or more cell site systems, each transmitting information about multiple cellphones to the central site system.

C. SIGNAL INFORMATION SENT FROM BASE STATION TRANSCEIVERS

D. TIMING INFORMATION

The cell site system in the patent transmits timing information to the base station as a time of arrival obtained from the timing signal receiver.

E. CALCULATING CELLPHONE LOCATION FROM TIME DIFFERENCE OF ARRIVAL

By contrast the central site system in the '144 patent stores ideal time difference of arrival information for a set of reference locations. It then computes the squared difference between the calculated time difference of arrival for each cellphone that it monitors. It uses the squared difference calculations to determine an approximate cellphone location and proceeds to use a method of linearized-weighted-least-squares iterations to arrive at its final location estimate.

VI. INFRINGEMENT ANALYSIS

A. SUMMARY OF OPINIONS

In my opinion, Dr. Gottesman has not proved that the Andrew Geometrix System infringes any asserted independent claim of the '144 patent (1, 22, and 31). Therefore, he has not proved that the Andrew System infringes any asserted dependent claim either. Additionally, Claim 32 (like claim 22) is not infringed for the additional, independent reason that Dr. Gottesman has not proved that Andrew's Geometrix product has a